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ABSTRACT

This paper uses data from a survey of K-12 unit schools to fashion a measure of small school sustainability and relate it to variables pertinent to the rural context. Drawing on definitions of sustainable development and sustainable agriculture, this study proposes sustainability as a concept appropriate to schooling in general, and to small rural schools in specific. Data analysis is illustrative and exploratory. Superintendents of 159 school districts containing 205 K-12 schools completed an extensive survey covering demography, educational opportunities, special education, extracurricular activities, staffing, distance learning technology, fiscal practices, community attitudes, and political dilemmas. The first task of exploratory analysis was the classification of 27 variables in the data set as reflecting practices plausibly related to 3 commitments of a centrist definition of sustainability (conservation, stewardship, long-term vitality). Descriptive statistics and a factor analysis describe the dependent variable (sustainability). From the contextual data provided by superintendents, 13 possible independent variables were selected and then narrowed to 8. These predictor variables explained 40 percent and 15 percent of the variance in sustainability in K-12 schools in multi-school districts and single-school districts, respectively. The differences between these two groups related principally to "economy of place," a composite variable of geographic location, economic base, local control, and local fiscal contribution. Analyses suggest sustainability can be related to features of the rural circumstance. Recommendations for further work are included. Contains 29 references. (SV)

ED 405 165

# Sustainable Small Schools in the Rural U.S.: Construct and Exploratory Analysis

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Sustainable Small Schools in the Rural U.S.: Construct and Exploratory Analysis

Some observers have raised an interesting question in light of policy makers' championship of systemic reform (Vinovskis, 1996) and the street-level habit of regarding norm-referenced tests as *the bottom line*. They have asked if public schooling is a sustainable enterprise in the United States (cf. Matthews, 1996; Lasch, 1991; Strike, in press). Other observers answer that it is not, and they would take the 20th century admonition to run schools as businesses are run (e.g., Callahan, 1962) to its logical conclusion, namely making schools *into* businesses (e.g., Chubb & Moe, 1991). Still others have advised doing away with schools altogether (e.g., Illich, 1970; Perelman, 1992). The voucher movement, the charter school movement, and the homeschooling movement suggest that, after 200 years, public support for public schooling in the U.S. has begun to decline (cf. Matthews, 1996).

There is, in short, ample reason to be concerned with the sustainability of schooling in general. For our part, we believe that schools are here for some time to come, if for no other purpose than that they provide excellent low-cost child care for parents who labor outside the home in a "global economy." This is an important public good when nearly all parents are expected to find and hold such employment.[1] We are also concerned about the need for rural schools that help sustain rural communities as places where young adults will want to live in the 21st century (Harmon & Howley, in press).

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[1]Job-holding and money economies are largely 20th century inventions, corollaries of industrialization and urbanization. In many families all the parents there are, work. These developments are not likely to reverse themselves, barring national or global economic disaster. That schools keep youth *out* of the job market is also a benefit of schooling.

Sustainability

A United Nations' report defines "sustainable development" as development that meets present needs without compromising the ability of future generations to meet their own needs (World Commission, 1987). Some writers, however, avoid linking the terms sustainable and development, seeing in the combination an oxymoron; sustainability does not put a premium on never-ending growth or large scale (e.g., Higgins, 1997). The UN definition nonetheless identifies a commitment common to most definitions: a viable future and a concern that present greed not subvert that viability.

Sustainability is a familiar concept in agriculture, but may be unfamiliar to many educators. Efficiency is a concept much more familiar to educators, so it is important first to relate the two concepts and then distinguish between them. Next we proceed to describe the commitments of sustainable agriculture that we will apply to help us operationalize a measure of the construct for use in this paper.

Efficiency. Even though the sustainability of an inefficient enterprise is generally considered dubious, sustainability is by no means assured by efficiency. Sustainability reflects a variable set of commitments, whereas school efficiency is most often construed in relationship to some objectively determined standard or set of standards--not only unit costs but also student achievement, a broad curriculum, the presumed indicators of effective schools, and so forth. It is very important to understand that the seeming distinction between efficiency and effectiveness that now prevails was much less sharp at the beginning of the 20th century (cf. Veblen, 1899/1979), and the two concepts retain in common an abstract or *foundational* standard of

performance that is understood to be *universally* applicable. Pursuit of such ("world-class") standards have resulted in dramatic rural school closures and district reorganizations, not to mention other disastrous effects throughout rural communities in the U.S. (e.g., Berry, 1978; Jackson, 1995). School closures and district consolidations have so reduced the numbers of schools and districts, that in the years between 1929 and 1989 a *60% increase in student enrollment* is associated with an *88% decrease in the number of districts* and a *68% decrease in the number of schools* (National Center for Education Statistics, 1995). The changes have been accomplished most often in the name of efficiency.

Unlike efficiency, sustainability is not principally adherence to an abstract or ideal standard. A world-class standard for sustainability is an oxymoron; sustainability lacks objectivity in the usual sense. Instead, sustainability is a set of commitments, which not only *may* be variously defined, but which *must* be variously defined *to honor* the worthy traditions and values of particular places. To judge the worthiness of these differing commitments one must ask what is being sustained (Gale & Cordray, 1994). In all cases, a legitimate claim of sustainability seems to require a connection to the common good. On this basis, for instance, one would face a difficult challenge in arguing that a local tradition of racism contributes to sustainability.

Sustainable agriculture. For the limited purposes of this paper, we use sustainable agriculture as a precedent because it represents a centrist position with wide currency. The U.S. Department of Agriculture (1991) defines the principles of sustainable agriculture as follows:

1. economic viability

2. social supportiveness, and

3. ecological soundness.

*Basic Principles* (U.S. Department of Agriculture, 1991) reports the definition adopted by Congress, as well:

> As defined by Congress, sustainable agriculture is "an integrated system of plant and animal production practices having a site-specific application that will, over the long term:
>
> 1. satisfy human food and fiber needs;
> 2. enhance environmental quality and the natural resource base upon which the agricultural economy depends;
> 3. make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls;
> 4. sustain the economic viability of farm operations; and
> 5. enhance the quality of life for farmers and society as a whole."

*Conservation*, *stewardship*, and the *long-term vitality* of the natural and social world are concepts common to both definitions. We adopt these three concepts and relate them to questions asked on a survey we recently conducted of superintendents of districts that operate a unique sort of rural school.

## Sustainable K-12 Unit Schools

In the past year we have been concerned to assist a rural superintendent interested in improving a remote K-12 school (a so-called "union" or "unit" school serving all school-age children in its attendance area--in this case about 80 children). While many such schools have probably been closed throughout the century (they are themselves the likely results of previous

closures), this particular school is unlikely to be closed. For that reason it must be included by a responsible administration in district improvement plans.

In planning how to improve eductional opportunity at the school, the superintendent wanted to know what other districts with such schools were doing. The literature base for K-12 schools is even thinner than for one-room schools, and we therefore conducted a national survey to help address the dilemmas confronted by the district. We have reported the results elsewhere (Howley & Harmon, 1996). The information was useful to the district, but also gives us a tailor-made data set with which to explore issues related to the sustainability of small schools. In fact, our interests in this matter were not dissimilar to those of the district, which, indeed, was concerned to sustain its particular small school. Our interest in this work also aligns with the overall mission of AEL's national rural education specialty.[2]

## Methods

The frame for the population of K-12 unit schools was provided by information in the National Center for Education Statistics' (NCES) *Common Core of Data* (CCD), which indicated there were 1,051 such schools located in 706 districts (National Center for Education Statistics, 1992). We developed the survey instrument with the help of a group of 10 superintendents who administered K-12 unit schools in rural districts in 8 states. Based on the information provided by the superintendents, we drafted the instrument; elicited feedback from two persons in AEL's

[2]The mission of the specialty is "to foster the integrity of small rural schools in a global economy." Five themes--sense of place, pathways to adulthood, unsettling America, small-scale organization, and policy challenges--identify the relevant concerns.

Planning, Research and Evaluation unit; pilot tested the instrument with the 10 collaborating superintendents; and prepared and administered the final survey protocol. Data were collected in May and June of 1996.

Target respondents were the superintendents of the 706 districts with at least one K-12 school. Schools were identified as those schools in the CCD with twelfth grade as their highest grade and pre-Kindergarten, Kindergarten, or first grade as their lowest grade. The CCD school records contain a local education agency identification number, and this number served to identify the 706 related districts. One followup effort resulted in valid responses from 159 respondents (22.5%) who provided valid information about a total of 205 schools. An additional 17 respondents indicated that there were no K-12 unit schools in their districts, suggesting that our overall response rate was 24.9%. Sample sizes for the various analyses reported here vary due to missing data.

Question. This article uses data from that survey to fashion a measure of sustainability and attempt to relate it to variables pertinent to the rural context. We ask if, among respondents, such contextual variables predict our measure of sustainability.

For four reasons, the data set seems to us peculiarly well-suited to the purpose. First, K-12 unit schools represent an uncommon school configuration, and as a result they may encounter uncommon opportunities to practice conservation and stewardship and to cultivate long-term vitality. For instance, small size, rural locale, and remoteness might be hypothesized to combine to facilitate a close relationship between school and community. But, second, like other schools, these schools are also subject to professional norms that may, with respect to the uncommon

configuration of grades and small size, prove to be handicaps. In the case of the focus school, this was an evident concern of the district; they did not believe the school should imitate practices of larger, more urban schools conforming more closely to the ideal of industrial efficiency. Third, the K-12 unit schools were small, rural schools. Such schools have long been considered fit objects for "improvement" along the lines of urban and suburban norms--just the sort of improvement the district sought *not* to impose on the focal school. Finally, and partly in consideration of previous points, our questionnaire was extensive, and we gathered data on over 400 items reflecting demographics, educational opportunities, special education, extracurricular activities, staffing, distance learning technology, fiscal practices, community attitudes, and political dilemmas.[3]

Dependent variable. Our first task for this exploratory analysis was to examine our data set for items plausibly related to adherence to the commitments that inform our construct (i.e., conservation, stewardship, long-term vitality). We classified 27 variables as reflective of these commitments. Table 1 provides a description of the classification results.

[3] We sacrificed a high response rate in order to develop an extensive data set. The response rate is, in fact, impressive in view of the length of our instrument. Note again that we seek in this paper to illustrate a new idea and that we *do not* claim that our findings generalize to the population of all K-12 schools.

Table 1

Classification of Items Plausibly Contributing to Sustainability

| Conservation | Stewardship | Long-term Vitality |
|---|---|---|
| 1, 5, 9, 10, 11, 12, 23, 27 | 2, 6, 7, 8, 13 21, 25, 26 | 4, 3, 14, 15, 16, 17 18, 19, 20, 24 |

1. Degree of adequacy of basic academic offerings (L)
2. Local school and community influence on curriculum (L)
3. (Reverse) intramural instead of competitive sports (M)
4. Degree that community expectations for competitive sports are met (L)
5. Waivers obtained from SEA to permit adequate staffing (M)
6. Use of community volunteers to staff non-instructional positions (M)
7. Partner with other districts to staff (M)
8. Have teacher induction program (M)
9. Have future teachers club (M)
10. Use distance learning (DL) to provide certified instructors (M)
11. Use DL to provide vocational-technical instruction (M)
12. Use DL to provide professional development (M)
13. Use DL to provide classes for community members (M)
14. Degree to which DL is effective for students (L)
15. Degree to which DL is effective for professional development (L)
16. Degree to which DL is effective for community (L)
17. Degree to which students perform well on norm-referenced tests (L)
18. Degree of student attendance (L)
19. Degree to which students complete high school (L)
20. Degree to which community (CY) believes students get good education (L)
21. Degree to which CY believes school reflects CY's values (L)
22. Degree to which CY believes school is integral part of CY (L)
23. Degree to which CY believes school offers adequate career counseling (L)
24. Degree to which CY believes students are motivated to achieve (L)
25. Degree to which CY believes parent involvement is adequate (L)
26. Degree to which school facilities are open to CY (L)
27. Previous consolidation attempts unsuccessful (M)

Note 1. All responses are opinions of respondent superintendents.

Note 2. M=multiple-response item; L=Likert item.

Readers should keep two features of this classification exercise in view. First, items were selected to reflect practices plausibly related to sustainability. Second, the defining commitments of sustainability served as a selection guide.[4] The goal was to select a sufficient pool of items from which to construct a single dependent measure; we were not interested to construct subscales reflecting particular commitments. That work must be left for a subsequent effort.

Having selected items plausibly related to sustainability, we calculated a set of derived variables that would indicate the presence or absence of a practice contributing to sustainability. That is, we produced consistently scored derived variables that could be aggregated to fashion our operationalized dependent measure ("sustainability"). We decided that ratings of "good" or "excellent" (4s or 5s) on Likert items would be recoded to indicate the practice was present on our derived variables; scores of 3 or less were considered to indicate absence of the practice. For multiple-response items, a checked item indicated presence of the practice; otherwise, the practice was presumed to be absent (one item was scored reversely, see Table 1).

We summed derived variables to produce a prospective dependent variable. We calculated descriptive statistics and performed an exploratory factor analysis on the contributing items in order to develop a description of how the 27 items contributed jointly to our prospective dependent variable ("sustainability," SUSTOTAL). Descriptive statistics show the dependent

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[4]Franklin & Glascock (1996) report on student outcomes for 78 K-12 schools in Louisiana; the researchers suggest that K-12 schools in that state are effective according to a variety of measures. Our inclination, reflected in Table 1, is to interpret effectiveness as an indicator of long-term vitality. An ineffective school can hardly claim vitality.

variable to be normally distributed, with a mean of about 13 and a standard deviation of about 4.

Table 2 reports descriptive statistics and results of the factor analysis.

Table 2

Sustainability Measure: Descriptive Statistics and Factor Structure

Descriptive Statistics for Sustainability Measure (SUSTOTAL)

| | | | | | |
|---|---|---|---|---|---|
| Mean | 12.907 | Median | 13.000 | Mode | 12.000 |
| Std dev | 3.967 | Skewness | -.086 | | |
| Minimum | 3.000 | Maximum | 25.000 | | |

Constituent Variables of Sustainability
with Factor Loadings Equal To or Greater Than .50

Factor 1: 22 (.79); 21 (.79); 23 (.74); 24 (.74); 20 (.73); 25 (.51)
Factor 2: 12 (.74); 13 (.72); 10 (69); 15 (.65); 14 (.58); 16 (.54)
Factor 3: 18 (.79); 19 (.76); 17 (.75)
Factor 4: 9 (.82); 8 (.72)
Factor 5: 27 (.67); 26 (.52)
Factor 6: 2 (.71); 4 (.66)
Factor 7: 7 (.74)
Factor 8: 5 (.61)

Note. Eigenvalues and percentage of variance accounted for by each factor, 1-8, respectively, are as follows (percentage of variance in parentheses): 4.59 (17.0%); 3.08 (11.4%); 2.00 (7.4%); 1.52 (5.6%); 1.48 (5.5%); 1.38 (5.1%); 1.29 (4.8%); 1.13 (4.2%). Cumulative percentage of variance accounted for by the 8 factors is 61.0%.

The factor analysis (principal components analysis with varimax rotation) reported 8 factors with eigenvalues greater than 1, accounting for 61% of total variance (see Table 2 for details). Because 23 of the 27 items showed factor loadings of at least r=.50, we concluded that little was to be gained by eliminating items from our operationalized dependent variable (SUSTOTAL).

Independent variables. Previous surveys of small rural districts with many K-12 schools (Barker & Hall, 1994; Barker & Muse, 1983; Ferre, Chang, & Lotven, 1991; Swift, 1982) have identified the major contextual concerns related to administration--fiscal and economic concerns, staffing barriers, and remoteness. Variables related to these topics were to become our independent (predictor) variables.

Our questionnaire had asked respondents to provide a good deal of contextual information about K-12 schools and the districts in which they were located: whether or not there were more than one school in the district, socioeconomic status of the district and the school, state, geographic remoteness of schools from a variety of resources and institutions (travel time), staffing barriers confronted by the district, distance learning systems used by the schools (based on Barker, 1992), fiscal practices used by the district (based on Inman-Freitas, 1992), per pupil operating expenditures, and information about local share of funding. We identified 36 relevant variables and from them selected the following 13 independent variables for possible use in subsequent regression analysis. Table 3 reports descriptive statistics for each of the selected variables.

Table 3

Independent Variables: Univariate Statistics

| Variable | N | Mean | Median | S.D. | Skewness | Minimum | Maximum |
|---|---|---|---|---|---|---|---|
| SINGLTON | 205 | .52 | 1 | .50 | -.07 | 0 | 1 |
| DD10_D | 199 | 2.16 | 2 | .98 | .42 | 1 | 5 |
| DD10_1 | 178 | 2.07 | 2 | .91 | .41 | 1 | 5 |
| DD10DIFF | 176 | .09 | 0 | .57 | .77 | -2 | 2 |
| DL_COUNT | 205 | 1.67 | 2 | 1.27 | .41 | 0 | 5 |
| PPEXPALL | 125 | 6267.72 | 5200.00 | 3836.83 | 4.02 | 2300.00 | 35000.00 |
| SE | 205 | .39 | 0 | .49 | .48 | 0 | 1 |
| AGRICULT | 205 | .41 | 0 | .49 | .39 | 0 | 1 |
| EQUILOCA | 205 | .13 | 0 | .33 | 2.26 | 0 | 1 |
| LOCPIPER | 205 | .15 | 0 | .35 | 2.02 | 0 | 1 |
| FP_SUM | 185 | 6.57 | 7 | 3.20 | .42 | 0 | 16 |
| STAF_BAR | 196 | 13.38 | 14 | 3.73 | -.21 | 5 | 22 |
| FAC1_6 | 205 | 0.00 | -.28 | 1.00 | 1.74 | -1.27 | 3.68 |

1. SINGLTON: whether or not K-12 unit school is only school in district
2. DD10_1: school SES 1 (lowest) through 5 (highest), national norms = 3
3. DD10_D: district SES (as for 2)
4. DD10DIFF: DD10_D - DD10_1 (disparity between district and school SES)
5. DLCOUNT: reported number of distance learning technologies used (1-5)
6. FAC1_6: remoteness factor score
7. PPEXPALL: reported school per pupil operating expenditures
8. LOCPIPER: local revenue at least 50% of school operating expense
9. AGRICULT: whether or not agriculture is district economic base
10. SE: whether or not state is in Southeast
11. STAFBAR: count of selected staffing barriers (0-5)
12. FP_SUM: sum of all fiscal practices used (0-16)
13. EQUILOCA: local course offerings warranted by district policy

Univariate statistics showed unacceptable levels of skewness for PPEXPALL, EQUILOCA, LOCPIPER, and FAC1_6. In addition, the proportion of missing cases for PPEXPALL was large. The combination of difficulties with PPEXPALL convinced us to exclude this variable from the analysis. The exclusion may be parsimonious, since two uncorrelated socioeconomic measures (DD10_1 and DD10DIFF) are available and each correlates significantly with the dependent variable. The remaining difficulties were overcome by various combinations and transformations, as follows: (1) We transformed FAC1_6 by first taking its inverse and then reversing the polarity of the obtained values to produce F16INVR[5], and (2) we summed EQUILOCA, LOCPIPER, AGRICULT, and SE to produce a more normally distributed variable ordinal variable, ECOPLACE, with values ranging from 1 to 5.[6] Because the bivariate correlation between DD10_D and DD10_1 was higher than that between DD10_1 and DD10DIFF, we decided to eliminate DD10_D from the final list of independent variables. Table 4 provides univariate statistics for the revised list; note that independent variables are not highly correlated with one another, but that 6 of our 8 independent variables correlate modestly at $p<.01$ with SUSTOTAL, our dependent variable.

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[5] F16INVR=(-1)*(1/FAC1_6). Reversing the polarity (multiplying by -1) maintains the positive direction of association of the independent variable with the dependent variable.

[6] ECOPLACE=(-SE)+(-AGRICULT)+EQUILOCA+LOCPIPER+3. The variables are summed with positive or negative values according to the sign of their relationship to the dependent variable; 3 is added to render all values as positive values. The variable might be interpreted as "economy of place."

Table 4

Revised Independent Variables: Univariate Statistics and Correlation Matrix

Univariate Statistics

| Variable | N | Mean | Median | S.D. | Skewness | Minimum | Maximum |
|---|---|---|---|---|---|---|---|
| SINGLTON | 205 | .52 | 1 | .50 | -.07 | 0 | 1 |
| DD10_1 | 176 | 2.07 | 2 | .91 | .41 | 1 | 5 |
| DD10DIFF | 176 | .09 | 0 | .57 | .77 | -2 | 2 |
| DL_COUNT | 205 | 1.67 | 2 | 1.27 | .41 | 0 | 5 |
| ECOPLACE | 205 | 2.48 | 3 | 1.04 | -.18 | 1 | 5 |
| FP_SUM | 185 | 6.57 | 7 | 3.20 | .42 | 0 | 16 |
| STAF_BAR | 196 | 13.38 | 14 | 3.73 | -.21 | 5 | 22 |
| F16UINVR | 205 | -.10 | -.10 | .009 | 1.19 | -.115 | -.073 |

Bivariate Correlation Matrix (Dependent and 8 Independent Variables)

| | SINGLTON | FP_SUM | STAF_BAR | DD10DIFF | F16UINVR | ECOPLACE | DD10_1 | DL_COUNT |
|---|---|---|---|---|---|---|---|---|
| FP_SUM | .1386 | | | | | | | |
| | ( 185) | | | | | | | |
| | P= .060 | | | | | | | |
| STAF_BAR | .0606 | .0557 | | | | | | |
| | ( 196) | ( 182) | | | | | | |
| | P= .570 | P= .455 | | | | | | |
| DD10DIFF | -.0276 | .0728 | -.0312 | | | | | |
| | ( 176) | ( 158) | ( 167) | | | | | |
| | P= .716 | P= .364 | P= .689 | | | | | |
| F16UINVR | .0697 | -.0321 | .0829 | .0177 | | | | |
| | ( 205) | ( 185) | ( 196) | ( 176) | | | | |
| | P= .321 | P= .665 | P= .248 | P= .815 | | | | |
| ECOPLACE | .6042 | .0956 | -.0316 | .0000 | .1541 | | | |
| | ( 205) | ( 185) | ( 196) | ( 176) | ( 205) | | | |
| | P= .000 | P= .195 | P= .660 | P=1.000 | P= .027 | | | |
| DD10_D | -.0760 | .0496 | -.3726 | .4043 | -.0284 | -.0244 | | |
| | ( 199) | ( 180) | ( 190) | ( 176) | ( 199) | ( 199) | | |
| | P= .286 | P= .508 | P= .000 | P= .000 | P= .690 | P= .733 | | |
| DL_COUNT | .1436 | .1097 | .0435 | .0513 | .1795 | .2233 | -.0993 | |
| | ( 205) | ( 185) | ( 196) | ( 176) | ( 205) | ( 205) | ( 176) | |
| | P= .040 | P= .137 | P= .545 | P= .499 | P= .010 | P= .001 | p= .187 | |
| SUBTOTAL | .2572 | .3092 | -.1151 | -.2178 | -.1371 | .2763 | .2447 | .2355 |
| | ( 204) | ( 185) | ( 196) | ( 175) | ( 204) | ( 204) | ( 177) | ( 204) |
| | P= .000 | P= .000 | P= .108 | P= .004 | P= .051 | P= .000 | P= .001 | P= .001 |

Note. ECOPLACE=(-SE)+(-AGRICULT)+(EQUILOCA)+LOCPIPER)+3; F16UINVR=(-1)/(FAC1_6), cf. Table 3.



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Findings

Our previous work with this data set (Howley & Harmon, 1996) suggested that there were substantial differences in the patterns that characterize data reported about K-12 unit schools by respondents in single versus multi-school districts (SINGLTON). Therefore we conducted three regression analyses: (1) for the entire sample of valid cases; (2) for multi-school districts only (SINGLTON=0); and (3) for single-school districts (SINGLTON=1). We also report various comparisons of means, in light of the results of the regression analyses.

Regression results. For all equations, SUSTOTAL was the dependent variable. Independent variables eligible for entry in the equations, however, necessarily varied according to the subset of schools. All 8 independent variables were used for the full sample (N=154, listwise deletion of cases); as the variable distinguishing between the two subsets, SINGLTON was excluded from both subsequent equations; and DD10DIFF was excluded from the equation for single-school districts.[7] Results of the regression analyses appear in Table 5.

The regression results show that a greater proportion of the variance of our dependent variable is predicted for K-12 schools in multi-school districts ($R^2$=.40) than for K-12 schools in single-school districts ($R^2$=.15). In addition, it is clear that a similar set of variables predicts the dependent variable for equations 1 (all K-12 unit schools) and 2 (K-12 schools in multi school districts): FP_SUM, DD10DIFF, DD10_1, and F16UINVR. There are, however, some differences.

[7]SINGLTON, of course, has no variance in subsets defined by this variable; DD10DIFF is not salient for single-school districts (i.e., the SES of the district is the SES of the school).

Table 5

Summary of Regression Analysis for Variables Predicting Sustainability

K-12 Unit Schools

| Variable | B | SE B | Beta | T | Sig T |
|---|---|---|---|---|---|
| SINGLTON | .84 | .72 | .11 | 1.158 | .24 |
| DL_COUNT | .65 | .21 | .22 | 3.139 | .00 |
| FP_SUM | .30 | .08 | .25 | 3.680 | .00 |
| STAF_BAR | -.06 | .08 | -.06 | -.809 | .42 |
| DD10DIFF | -1.56 | .48 | -.23 | -3.269 | .00 |
| DD10_1 | .96 | .32 | .23 | 3.041 | .00 |
| F16UINVR | -60.07 | 28.10 | -.15 | -2.138 | .03 |
| ECOPLACE | .57 | .35 | .16 | 1.645 | .10 |
| (Constant) | .82 | 3.56 | | .229 | .82 |

Adjusted R Square=.29; F=8.99, p=.0000; n=154 (listwise deletion of cases)

K-12 Unit Schools in Multi-school Districts

| Variable | B | SE B | Beta | T | Sig T |
|---|---|---|---|---|---|
| DL_COUNT | .55 | .28 | .18 | 1.919 | .06 |
| FP_SUM | .42 | .11 | .34 | 3.684 | .00 |
| STAF_BAR | -.03 | .09 | -.03 | -.305 | .76 |
| DD10DIFF | -1.78 | .53 | -.32 | -3.337 | .00 |
| DD10_1 | 1.19 | .42 | .28 | 2.838 | .01 |
| F16UINVR | -115.30 | 33.40 | -.32 | -3.452 | .00 |
| ECOPLACE | 1.13 | .39 | .27 | 2.934 | .00 |
| (Constant) | -7.18 | 4.34 | | -1.655 | .10 |

Adjusted R Square=.40; F=8.41; p=.0000; n=79 (listwise deletion of cases)

K-12 Unit Schools (Single-School Districts)

| Variable | B | SE B | Beta | T | Sig T |
|---|---|---|---|---|---|
| DL_COUNT | .87 | .29 | .33 | 3.019 | .00 |
| FP_SUM | .28 | .12 | .26 | 2.422 | .02 |
| STAF_BAR | -.17 | .12 | -.17 | -1.432 | .16 |
| DD10_1 | .48 | .47 | .12 | 1.039 | .30 |
| F16UINVR | 11.16 | 47.12 | .03 | .237 | .81 |
| ECOPLACE | -.98 | .62 | -.17 | -1.575 | .12 |
| (Constant) | 15.86 | 5.71 | | 2.780 | .01 |

Adjusted R Square=.15; F=3.28; p=.0067; n=76 (listwise deletion of cases)

DL_COUNT is significant at p<.05 in equation 1 but not equation 2, whereas ECOPLACE is significant in equation 2 but not in equation 1. STAF_BAR is the only independent variable significant in neither equation 1 nor 2 (nor in equation 3, for that matter).

Only two predictors in equation 3 (K-12 unit schools in single-school districts) exhibit statistical significance at p<.05, FP_SUM and DL_COUNT. The independent variables account for just 15 percent of the variance in the dependent variable in equation 3, as noted previously.

One hypothesis to account for the differences observed in the regression results is that the two subsets of schools (multi- versus single-school districts) differ according to at least some of the independent variables appearing in equation 2 but not in equation 3. The fact that SINGLTON is not significant in equation 1 tends to support this hypothesis, as does the comparatively strong bivariate correlation (r=.68) between SINGLTON and ECOPLACE (see Table 4).

Comparison of means. Three variables significant in equation 2 are not significant in equation 3, namely DD10_1 (school SES), F16INVR (remoteness factor score), and ECOPLACE (economy of place). A means procedure demonstrated that the subgroups (multi- versus single-school districts) differed significantly only on ECOPLACE (1.75, n=99; versus 3.17, n=106, respectively, p=.0000). We next asked if mean values of ECOPLACE might covary with either DD10_1 or F16INVR. The ANOVA indicated that means did covary with F16INVR (p=.003) but not DD10_1 (p=.682).

This result led us to suspect that F16INVR and SINGLTON might interact to influence ECOPLACE. We tested this proposition by first dividing F16INVR at the median and then performing a two-way ANOVA. The most practical interpretation of this result is that, for multi-

school districts only, remoteness increases ECOPLACE values for K-12 unit schools. Results, including cell means and sample sizes, appear in Table 6, and confirm a two-way interaction.

Table 6

Two-Way Analysis of Variance for ECOPLACE

Main and Interaction Effects

| Source | df | F | P | Effect Size |
|---|---|---|---|---|
| Main Effects | 2 | 99.03 | .000 | |
| SINGLTON (A) | 1 | 188.72 | .000 | 1.42 |
| REM_HILO (B) | 1 | 9.34 | .003 | |
| Interactions | | | | |
| A x B | 1 | 4.03 | .046 | |

Cell Means for ECOPLACE

| | | REM_HILO 0 | REM_HILO 1 |
|---|---|---|---|
| SINGLTON | 0 | 1.53 ( 60) | 2.08 ( 39) |
| | 1 | 3.10 ( 41) | 3.22 ( 65) |

Note 1. Effect sizes based on mean differences for the main effects are 1.42 (SINGLTON) and 0.61 (REM_HILO). One-way ANOVA does not confirm equal variance for SINGLTON but does confirm it for REM_HILO. These problematic results may indicate a population difference, and we consider this issue further in the limitations section. We report these two-way results because we believe they have theoretical significance, as we explain in our remarks section.

Finally, given the disparities in multi- versus single-school districts, we were curious about the difference in means on our dependent measure between K-12 unit schools in multi- and single-school districts. We performed a one-way ANOVA which confirmed, as one might suspect, the existence of a statistically significant difference favoring the single-school district group (13.90 vs. 11.86, effect size=.55, p=.0002, n=204).

## Discussion

This paper used survey data reported by superintendents of 159 districts with K-12 unit schools to explore the concept of the "sustainability" of such schools. Using these data, we derived a measure of sustainability intended to reflect three commitments commonly acknowledged in the literature on sustainable agriculture; we also derived a hypothetically related set of eight predictor variables salient to the rural context.

Summary of findings. Statistical analysis showed the predictor variables to explain 30, 40, and 15 percent of the variance in the dependent variable for three groups of K-12 unit schools: (1) all K-12 unit schools in the sample, (2) K-12 unit schools in districts with more than one school, and (3) K-12 unit schools in districts with only one school (i.e., the K-12 unit school itself). The pattern of predictor variables differed for groups 2 and 3.

Subsequent analysis showed these differences to relate principally to ECOPLACE, a composite count variable of four dichotomous variables relating to geographic location (not southeast), economic base (not agricultural), policy that establishes local influence on curriculum, and a high degree of local fiscal contribution to the school--which composite we characterize as "economy of place." ECOPLACE exhibits the strongest correlation with another

independent variable (SINGLTON, r=.68) as well as a moderate correlation (r=.27) with the dependent variable. Further, we found evidence that for schools in multi-school districts only, a higher value of ECOPLACE is associated with remote location.

Finally, we compared the means on our dependent variable (SUSTOTAL) for the multi-school versus the single-school groups. The observed difference of 2.04 is equivalent to an effect size of about .55 (2.04/3.7, the ratio of the difference in means to the SD of the multi-school group). This finding suggests that, in light of data from reporting superintendents, K-12 unit schools in single-school districts (as represented in our data set) adhere more closely to the construct of sustainability as we have defined it in this case.

Remarks. We offer two principal observations related to these findings. First, a more theoretical interpretation of findings from the two-way ANOVA (see Table 6 note) is that remoteness and scale jointly affect "economy of place" such that increased scale (e.g., via consolidation or reorganization) among remote schools diminishes "economy of place," whereas decreases in scale among schools that are not remote enhances "economy of place." This interpretation, though based on a problematic ANOVA, is nonetheless internally consistent with data from the regression analyses in which the relevant regression coefficients in the first panel of Table 5 are oppositely signed. It is also consistent with disparate findings and positions in the literatures of rural education, school reform, and social organization (e.g., Bell, 1976; Callahan, 1962; DeYoung, 1995; Haller & Monk, 1988). One might hypothesize that sense of place facilitates sustainability.

Second, we believe this exploratory analysis demonstrates that sustainability is a construct theoretically applicable to small schools. We also believe that the constract is

important practically for small schools in light of two trends. The first trend is the century-long history of consolidation. This trend can be construed as the "massification" of public education to the point that the sustainability of public schooling itself is in serious doubt. Massification, based on the imputed value of efficiency, has endangered not only small schools, but public schooling itself. The second trend is the wide-spread praise now being bestowed on small schools. The great irony is that the strongest praise for small schools now comes from *urban* reform efforts, where small schools are a *reform concept*, and proponents in cities ask one another if they are "doing small schools." In rural places, small schools are a *common structural reality*, and even where consolidation has produced large schools on the old urban model, small schools are a still clear memory. We argue that sustaining the existence of both sorts of smallness, *rural and urban*, is important, if not critical, to the sustainability of public education in the U.S. The U.S. needs *more* public schools, and that position means that *smaller* schools need to be established and supported. Sustainability is a construct that has the potential to capture such commitments as conservation, stewardship, and long-trem vitality that will be required for such an undertaking to succeed.

Limitations. Our data were properly gathered as part of a technical assistance effort, not as part of a study of sustainability per se. We do not claim that our data set allows us to generalize findings to the universe of K-12 unit schools, or to the universe of small rural schools. All data were self-report of superintendents. We did not survey teachers, principals, community members, nor observe actual practices reported by superintendents.

This analysis is exploratory in at least three senses: (1) to our knowledge, this is the first time sustainability has been considered in this light; (2) the construct of "sustainability" rests on

commitments that may legitimately vary, and (3) neither the survey methodology nor the data gathered are ideally suited to a factual portrayal of any particular sort of sustainability. The analysis is intended as an exploration of the construct of sustainability rather than an empirical investigation of sustainability. The analysis employs available data to elaborate and explore logical relationships.

Finally, it must be noted that the integrity of the data rest on perceptions of superintendents. Our exploration is in fact an exploration of the structure of those perceptions as probed by our questionnaire. For this reason, the differences between reports of superintendents of K-12 multi-school districts and K-12 single-school districts may constitute a *difference of kind* sufficient to make single-school districts (as they are respesented in our data set) a different population; superintendents of single-school districts are not only superintendents but principals, and as a result their perceptions may differ sharply from those of their superintendent colleagues in multi-school districts. The role difference of respondents may account for the difference in variance associated with ECOPLACE (see Table 6 note) and may skew other results reported. Readers are cautioned, again, about the exploratory nature of our analysis and discussion.

## Recommendations

Some writers (e.g., Higgins, 1997) suggest that the term "sustainable" is overused but valuable. Such criticism doubtless refer to the use the term enjoys in denoting a wide range of values, a range that runs the gamut of values from left to center to right (cf. Gale & Cordray, 1994).

Nonetheless, in education, the term is by no means widely used. According to our

perusal of recent accessions to the ERIC database, "sustainable development" is *a topic of schooling* (i.e., a topic of the curriculum in environmental education and in social studies), but "sustainability" is not considered to be *a principle to guide the operation of schools*. A few astute educational writers have pointed out the relevance of sustainable communities to the continued existence of small rural schools, and implicit in these few analyses is the clear recognition that school and community may mutually sustain one another (e.g., Nachtigal, 1994).

Before one can reasonably conduct proper rather than exploratory and illustrative empirical analyses, however, relevant species of sustainability need to be considered. For the sake of illustration, this paper has used a centrist definition. Definitions that reflect concepts more particularly salient to the sustainability of small rural schools need to be developed, in our view. Gale and Cordray's (1994) exposition is a reasonable place to start, but conversations with communities should inform the work as well, as should reading about alternative economies (Trosper, 1995; Sklar, 1995). Trosper, for instance, includes *humility* as a commitment characteristic of traditional American Indian economic. Needless to add, humility is also a Christian virtue much neglected in neoclassical economic thought.

The fact that "sustainability" is less related to efficiency than to properly varying commitments means that qualitative work is essential. An initial study would include surveys of community members, audits of actual practices, and on-site visits to conduct interviews and participate in events. In addition, a data set more properly suited to a factual and generalizable portrayal of sustainability would gather data from principals of K-12 schools in multi-school districts as well as from superintendents in such districts. Clearly, we believe this would be interesting, useful, and important work, and we believe this paper helps to warrant it.

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